1970 OPERATING SUMMARY

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WATERLOO

water pollution control plant

ONTARIO WATER RESOURCES COMMISSION
Division of Plant Operations

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Water management in Ontario

Ontario
Water Resources
Commission

135 St. Clair Ave. W.
Toronto 195
Ontario

Once again we have the privilege of submitting to you our latest detailed report on financial progress and technical activity at your water pollution control plant.

The statistical information contained in this annual operating summary will undoubtedly be a useful barometer of efficiency. Of particular interest will be the comments and recommendations of the regional operations engineer, who was intimately connected with day-to-day operation throughout 1970.

Together with the extensive cost data provided, this information should assist greatly in your general understanding of the problems met and dealt with, and in furnishing a yardstick for possible future expansion.

DS Caverly

D. S. Caverly,
General Manager.

D McTavish

D. A. McTavish, P. Eng.,
Director,
Division of Plant Operations.

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135 St. Clair Avenue West
Toronto 195

WATERLOO

water pollution control plant

operated for

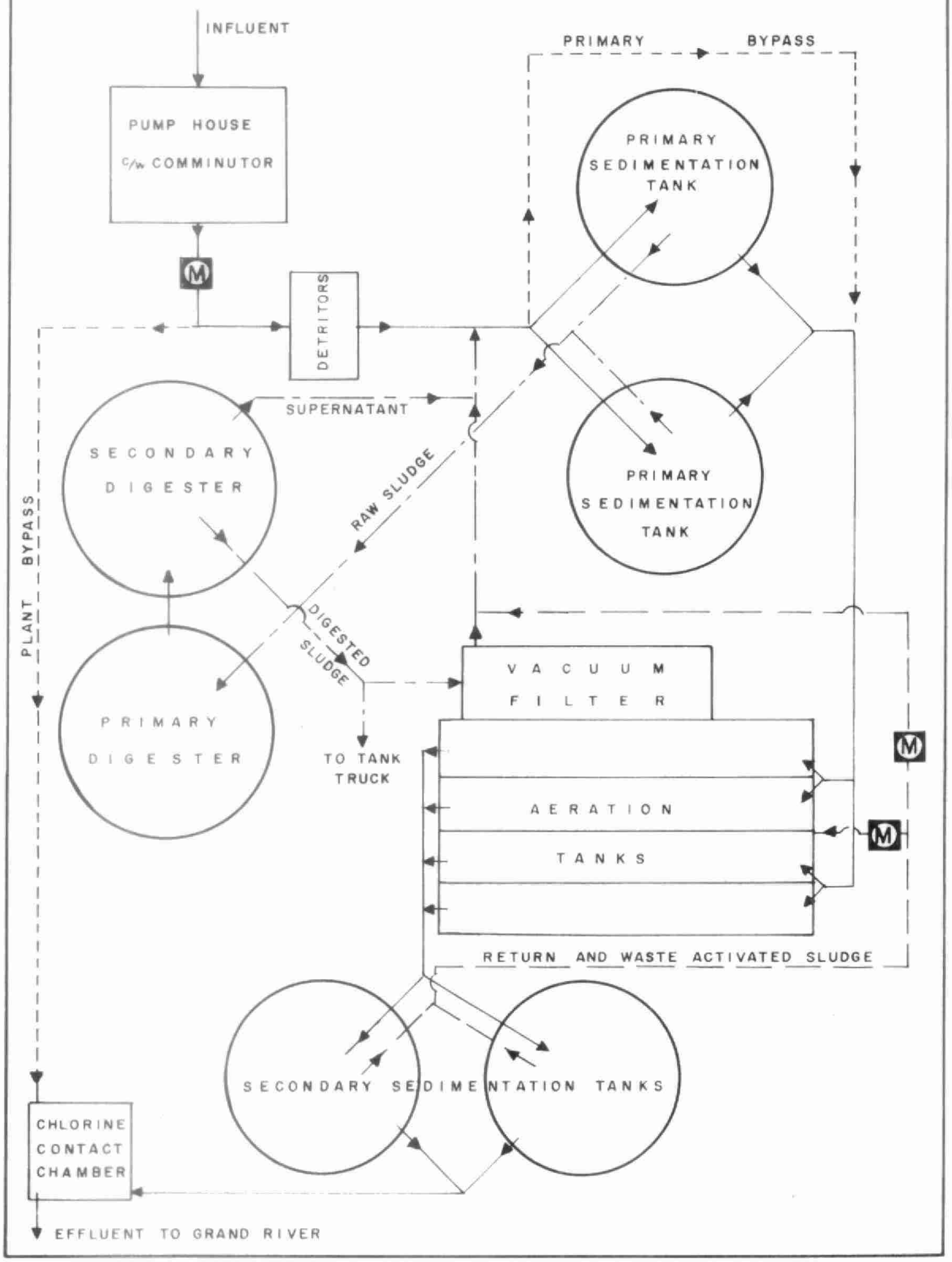
THE CITY OF WATERLOO

by the

ONTARIO WATER RESOURCES COMMISSION

1970 ANNUAL OPERATING SUMMARY

WATERLOO
WATER POLLUTION CONTROL PLANT



DESIGN DATA

PROJECT NOS. 2-0022-58 and 2-0203-66			
DESIGN FLOW	6.0 mgd*	DESIGN POPULATION	30,000
BOD - Raw Sewage - Removal	300 mg/l 90%	SS - Raw Sewage - Removal	270 mg/l 90%

PRIMARY TREATMENT

Comminution

One Worthington

Sewage Lift Station

Type: Canada Pump
Size: Two 2900 gpm @ 32' tdh (el)
One 5000 gpm @ 32' tdh (diesel)

Grit Removal

Type: Dorr Detritor
Size: Two 14' x 14' x 1.6' (3,900 gal)
Retention: 0.94 min

Primary Sedimentation

Type: Dorr
Size: Two 75' dia x 13' swd (0.772 mil gal)
Retention: 3.09 hours
Loading: Surface, 680 gal/ft^2/day
Weir, 12,700 gal/ft/day

SECONDARY TREATMENT

Aeration Tanks

Type: Diffused air, single-pass with turbine aerators
Size: Four 134' x $32\frac{1}{2}$' x $15\frac{1}{2}$' (1.68 mil gal)
Retention: 6.7 hours

Diffusers

(a) Spargers (66/tank)
(b) "Lightnin" Turbine (3/tank)

Air Supply

Type: Sutorbilt
Size: Two 3,750 cfm

Secondary Sedimentation

Type: Dorr
Size: Two 65' dia x 10' swd (0.458 mil gal)
Retention: 1.8 hours
Loading: Surface, 905 gal/ft^2/day
Weir, 14,650 gal/ft/day

CHLORINATION

Type: BIF
Size: One 400 lb/day

OUTFALL

- to Grand River

SLUDGE HANDLING

Digestion System - Two-stage

Primary - fixed cover
Type: Dorr draft tubes (3)
Size: One 80' x $21\frac{1}{2}$' swd (124,500 cu ft or 0.776 mil gal)
Loading: 3.5 lb/cu ft/mo

Secondary -
Size: One 80' dia x 20' swd (117,000 cu ft or 0.73 mil gal)
Total Loading: 1.8 lb/cu ft/mo

Vacuum Filter

Type: Komline-Sanderson
Size: One 300 sq ft

* Secondary clarifier 4.0 mgd design rate

'70 REVIEW

FLOWS	DAILY FLOW mil gal	OCCURRING IN THE MONTH OF	MONTHLY FLOW mil gal	OCCURRING IN THE MONTH OF
Average	4.89	—	149	—
High	5.78	October	179	October
Low	4.32	May	134	June

GENERAL

The average daily flow for the year of 4.89 million gallons was a decrease of 0.11 million gallons from 1969. In 1970 the plant treated a total of 1,784 million gallons of sewage at a total cost of $166,390.69. The operating cost per million gallons was $93.26 and the cost per pound of BOD removed was three cents.

The secondary clarification units do not possess the capacity to efficiently treat the flows received at Waterloo. The hydraulic overload causes the sludge blanket to rise and overflow the clarifier weirs, providing at times, a very poor effluent. In 1970, it was proposed that tube settlers be installed in the final clarifiers but, the manufacturer would not guarantee the effective operation of tube settlers with the rising sludge blanket in the final clarifiers. Therefore it is now necessary to construct additional clarifiers at the plant so that the hydraulic capacity of secondary treatment is the same as primary treatment, i.e., 6 mgd.

The primary digester was emptied so that repairs to the roof could be made by the contractor in order to stop the gas leaks. The digester was put back into operation in the month of August after taking six weeks for emptying and repair work.

During the year there have been considerable problems with the presence of oil in the aerator motors. The main problem is that oil is escaping through the oil seal from the reduction units into the motors. The manufacturer is trying to solve these problems by repairing and/or replacing the motors seals. Fortunately, the plant process has not been adversely affected by these problems.

PLANT FLOWS and CHLORINATION

The average daily flow of 4.89 million gallons decreased from 2% in 1969 . The daily design flow was exceeded 9% of the time.

An average chlorine dosage rate of 3.8 mg/l was necessary to maintain an average chlorine residual of 0.5 mg/l in the final effluent.

PLANT EFFICIENCY

The raw sewage BOD averaged 332 mg/l with the design raw sewage BOD concentration of 300 mg/l being exceeded 50% of the time.

The raw sewage suspended solids averaged 286 mg/l with the design raw sewage suspended solids concentration of 270 mg/l being exceeded approximately 53% of the time.

Average BOD and suspended solids in the effluent were 22 and 30 mg/l, a reduction of 92 and 89% respectively. The average suspended solids in the effluent is a decrease of 16 mg/l from 1969, but still the OWRC objectives of 15 mg/l for BOD and suspended solids were exceeded 60 and 75% of the time.

SLUDGE DIGESTION

A total of 83.1 mg of sludge was pumped to the primary digesters. The raw sludge averaged 4.7% total solids, of which 66% was volatile matter.

Digested sludge from the secondary digesters averaged 3.1% total solids of which 54% was volatile matter. The average reduction of volatile matter was 39.5%. This was slightly lower than existing comparative standards.

AERATION

The average MLSS concentration of 2,920 mg/l and the F/M ratio of 0.32 are within the accepted limits of good aeration tank operation.

CONCLUSIONS

The design flow can be increased from 4 mgd to approximately 6 mgd in the secondary treatment with additional final clarifiers. A significant decrease in the concentration of BOD and suspended solids in the effluent is expected, thereby meeting the OWRC's objectives of 15 mg/l for both BOD and suspended solids.

Considering the high organic and hydraulic loading and the underdesigned secondary clarification units, the plant maintained a high degree of efficiency producing a fairly good effluent during the year.

RECOMMENDATIONS

Expansion of the final clarifiers should commence immediately so that the hydraulic loading to the plant can be adequately handled.

PROJECT COSTS

STAGE 1

NET CAPITAL COST (Final)	$728,675.93
DEDUCT - Portion financed by CMHC/MDLB (Final)	-
Long Term Debt to OWRC	$728,675.93
Debt Retirement Balance at Credit (Sinking Fund) December 31, 1970	$350,827.93

Net Operating	$166,496.45
Debt Retirement	26,436.00
Reserve	4,165.64
Interest Charged	40,824.96
TOTAL	$237,923.05

RESERVE ACCOUNT

Balance @ January 1, 1970	$ 37,350.01
Deposited by Municipality	4,165.64
Interest Earned	2,510.51
	$ 44,026.16
Less Expenditures	-
Balance @ December 31, 1970	$ 44,026.16

STAGE 2 (Transformer Bank)

NET CAPITAL COST (Final)	$13,226.41
DEDUCT - Portion financed by CMHC/MDLB (Final)	-
Long Term Debt to OWRC	$13,226.41

Debt Retirement Balance at Credit (Sinking Fund) December 31, 1970	$ 5,555.46

Net Operating	$ -
Debt Retirement	552.00
Reserve	107.44
Interest Charged	741.03
TOTAL	$ 1,400.47

RESERVE ACCOUNT

Balance @ January 1, 1970	$ 1,270.58
Deposited by Municipality	107.44
Interest Earned	84.57
	$ 1,462.59
Less Expenditures	-
Balance @ December 31, 1970	$ 1,462.59

2-0203-66 (Plant Extensions)

NET CAPITAL COST (Final)		$1,277,650.29
DEDUCT - Portion financed by CMHC/MDLB (Final)		853,508.30
Long Term Debt to OWRC	$	424,141.99
Debt Retirement Balance at Credit (Sinking Fund) December 31, 1970	$	31,890.36
Net Operating	$	-
Debt Retirement		15,248.00
Reserve		11,381.76
Interest Charged		28,186.52
TOTAL	$	54,816.28

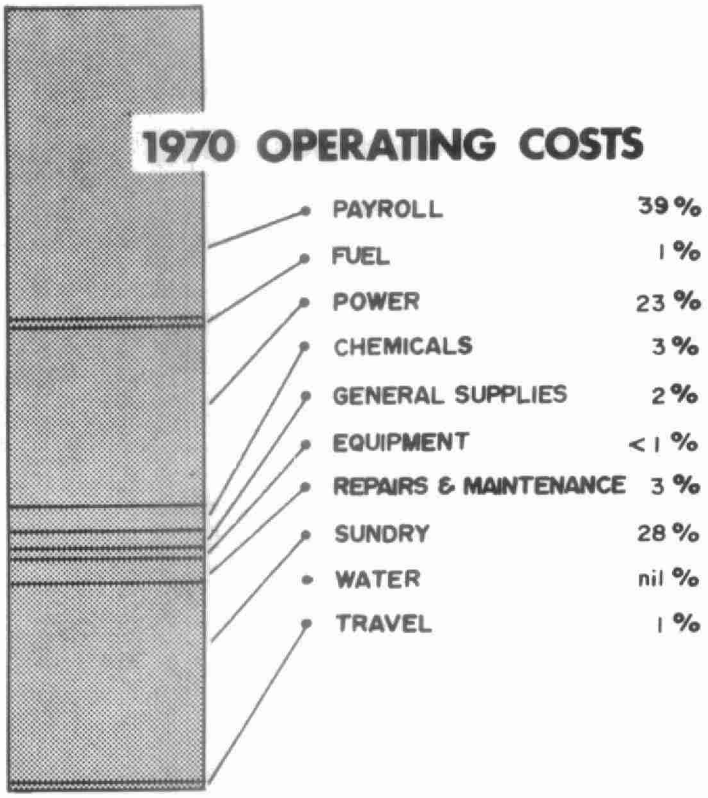
RESERVE ACCOUNT

Balance @ January 1, 1970	$	11,802.00
Deposited by Municipality		11,381.76
Interest Earned		1,051.13
	$	24,234.89
Less Expenditures		-
Balance @ December 31, 1970	$	24,234.89

SPECIAL OPERATING AGREEMENT

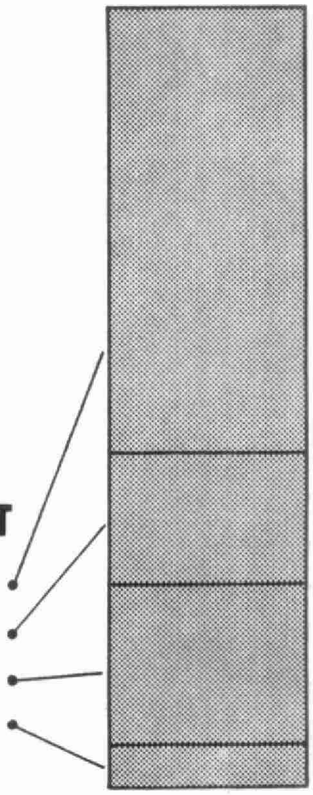
RESERVE ACCOUNT

Balance @ January 1, 1970	$5,215.76
Deposited by Municipality	1,159.69
Interest Earned	365.50
	$6,740.95
Less Expenditures	-
Balance @ December 31, 1970	$6,740.95



1970 OPERATING COSTS

TOTAL ANNUAL COST



Yearly Operating Costs

YEAR	MILLION GALLONS TREATED	TOTAL OPERATING COSTS	COST PER MILLION GAL	COST PER LB OF BOD REMOVED
1966	1139.85	$120,343.71	$105.58	4 cents
1967	1456.86	142,609.57	97.89	4 cents
1968	1533.7**	138,403.88	90.24	3 cents
1969	18 0.1	152,659.35	84.34	3 cents
1970	1784.0	166,390.69	93.27	3 cents

MONTHLY OPERATING COSTS

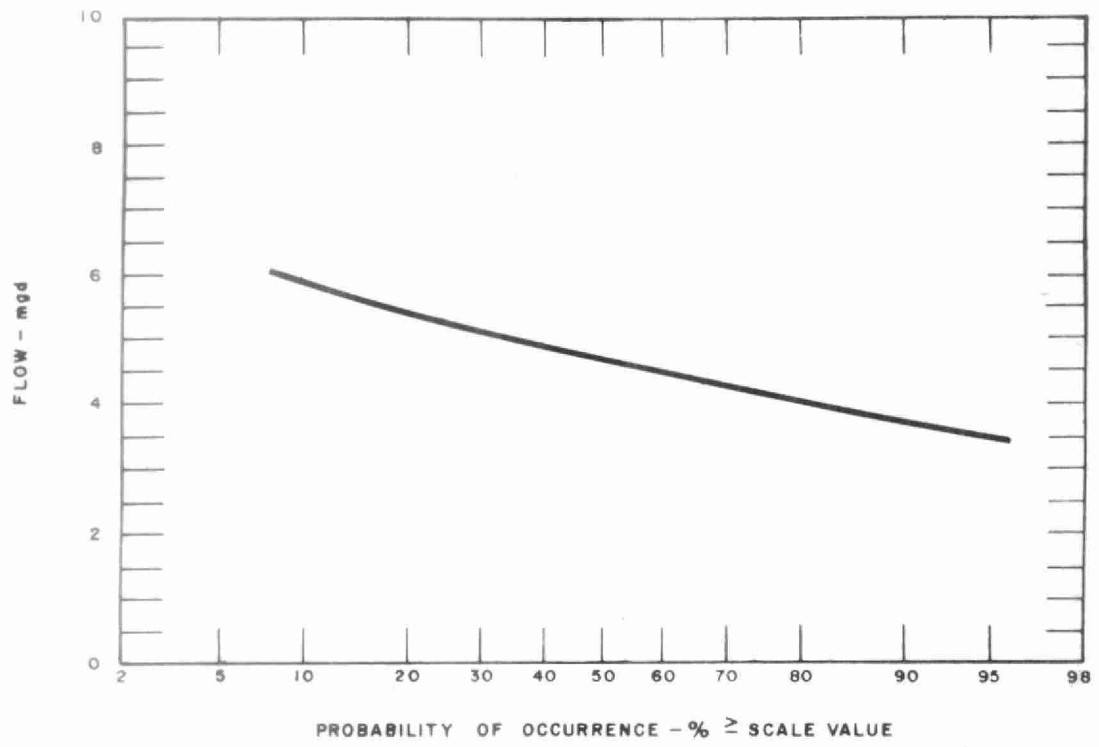
MONTH	TOTAL EXPENDITURE	PAYROLL	CASUAL PAYROLL	FUEL	POWER	CHEMICALS	GENERAL SUPPLIES	EQUIPMENT	REPAIRS and MAINTENANCE	SUNDRY *	WATER	TRAVEL
JAN	11780.82	6929.55	-	197.87	2538.27	-	218.38	-	6.30	1728.45	-	162.00
FEB	7226.42	4943.70	-	249.58	-	102.90	526.26	208.83	57.94	1083.85	-	53.36
MAR	17284.09	5016.24	-	-	5453.60	1866.90	326.10	198.16	192.64	4194.41	-	36.04
APR	11762.30	4923.37	-	-	2814.73	-	291.29	67.06	666.57	2931.85	-	67.43
MAY	17230.17	5427.88	-	208.60	3215.53	-	221.89	-	15.00	8041.72	-	99.55
JUNE	13318.48	4888.87	355.06	-	2722.23	-	519.97	45.85	427.98	4152.13	-	206.39
JULY	16491.03	4750.68	481.67	-	2932.33	-	442.93	49.81	330.01	7366.80	-	136.80
AUG	16645.31	7233.71	541.34	-	2886.68	-	110.82	9.64	543.58	5158.54	-	161.00
SEPT	12334.41	4816.16	40.45	-	3119.60	-	322.96	-	241.34	3762.49	-	31.41
OCT	14794.05	4795.92	-	-	3384.52	1220.10	370.51	300.00	502.79	4163.30	-	56.91
NOV	12788.37	4748.06	-	231.55	3617.46	1220.10	316.24	36.70	583.13	1910.35	-	124.78
DEC	14735.24	4737.55	-	305.28	6421.91	135.58	478.82	5.99	776.78	1563.36	-	309.97
TOTAL	166390.69	63211.69	1418.52	1192.88	29106.86	4545.58	4146.17	922.04	4344.06	46057.25	-	1445.64

BRACKETS INDICATE CREDIT

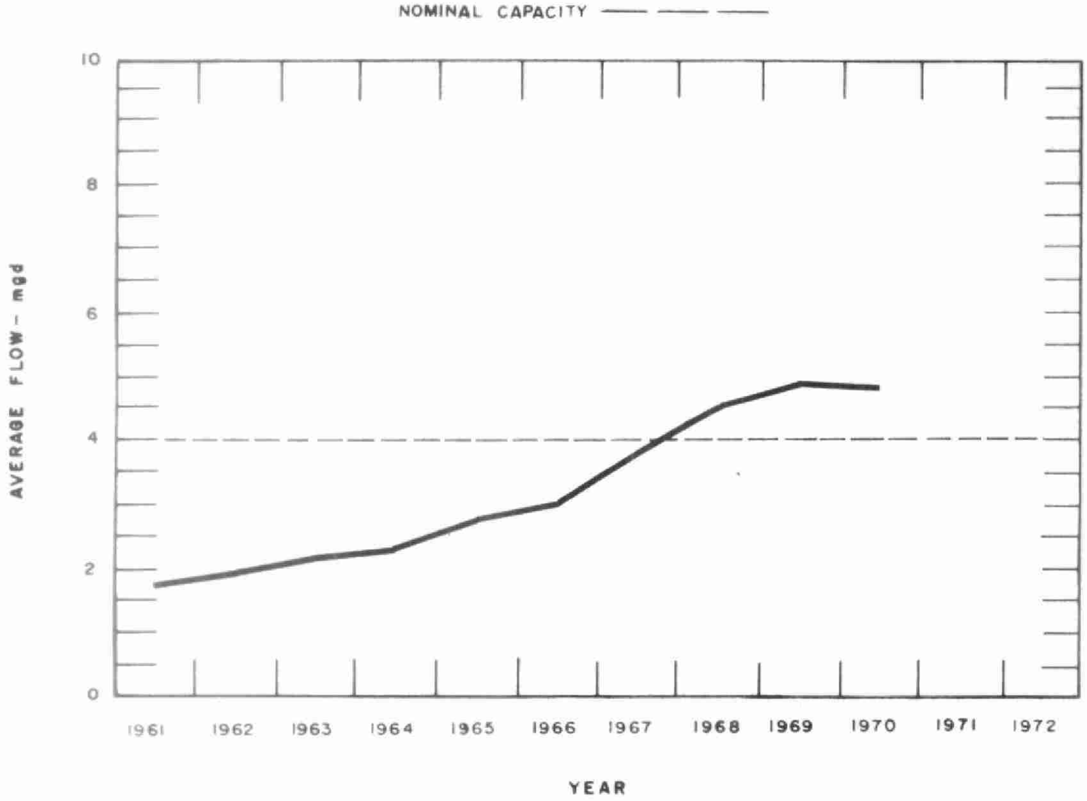
* SUNDRY INCLUDES SLUDGE HAULAGE COSTS WHICH WERE $40,849.73

Note: Total does not include year end adjustments.

PROCESS DATA



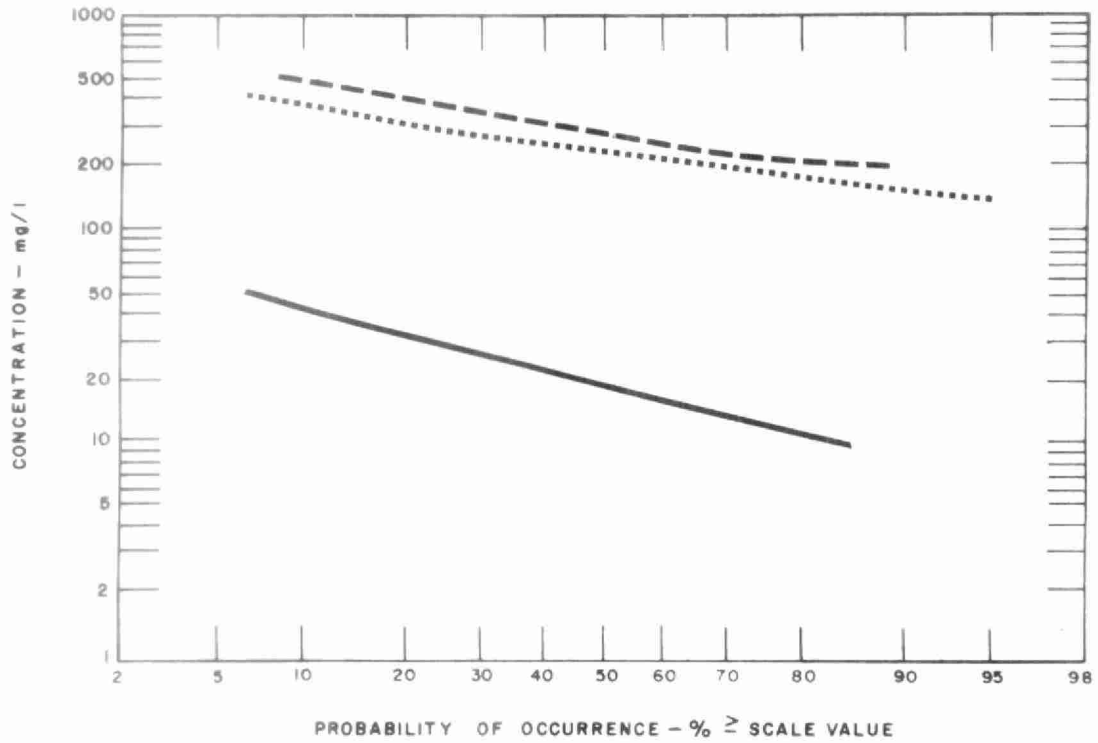
FLOWS



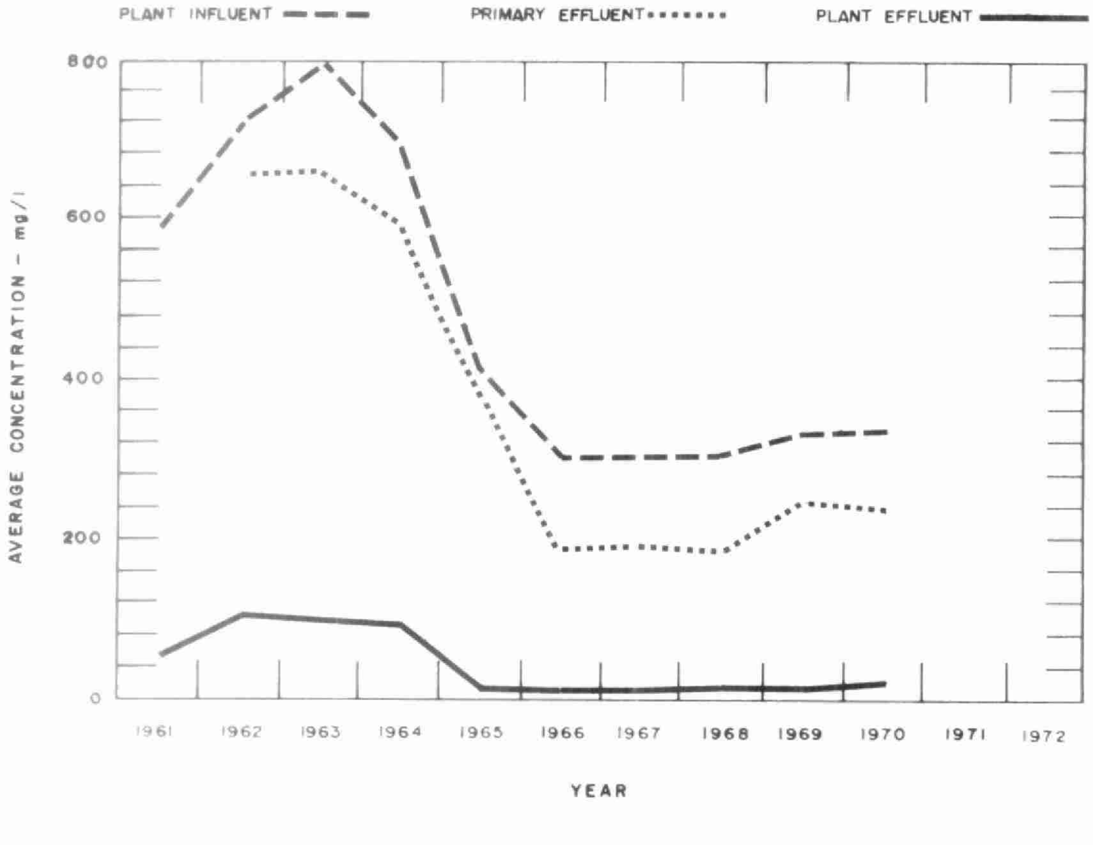
PLANT FLOWS and CHLORINATION

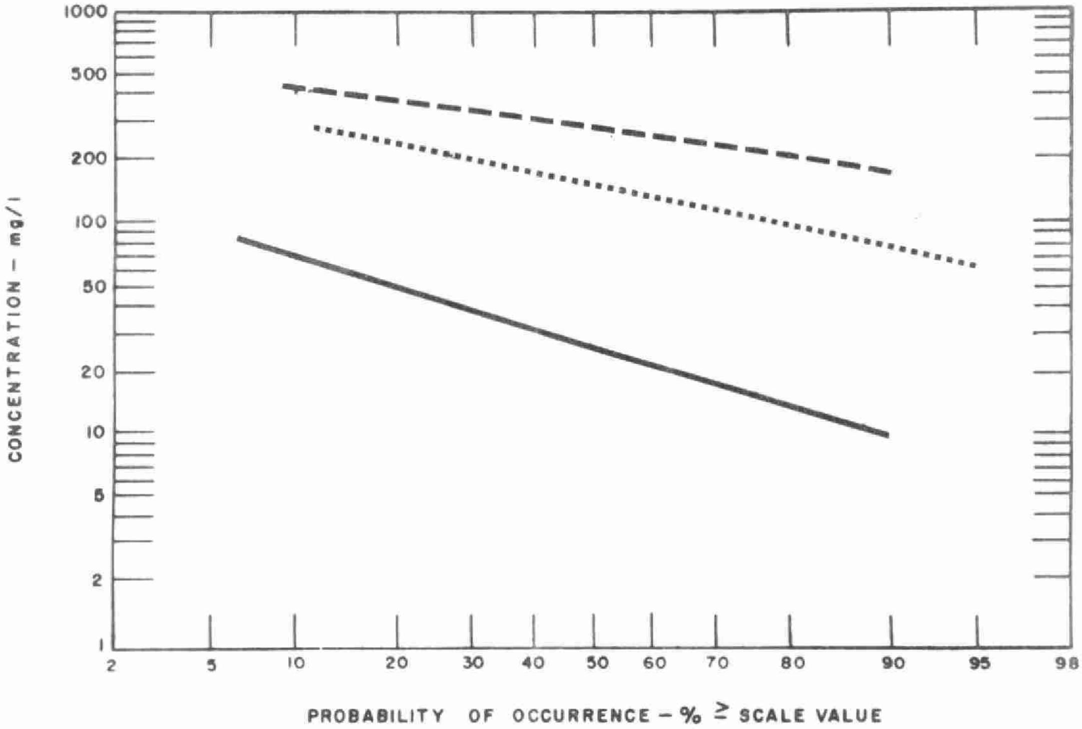
MONTH	TOTAL FLOW mil gal	AVERAGE DAILY FLOW mil gal	MAXIMUM DAILY FLOW mil gal	MINIMUM DAILY FLOW mil gal	CHLORINE USED 10^3 pounds	DOSAGE mg/l
JAN	154	4.98	6.5	3.9	6.7	4.3
FEB	141	5.04	6.3	4.0	5.7	4.0
MAR	145	4.7	6.8	3.3	6.7	4.6
APR	143	4.67	6.8	3.7	6.6	4.6
MAY	134	4.32	5.2	3.3	0	0
JUNE	134	4.47	6.0	2.9	2.5*	2.9
JULY	150	4.84	8.3	3.3	6.1	4.1
AUG	146	4.70	5.9	3.8	5.5	3.8
SEPT	146	4.86	5.9	3.5	5.8	3.5
OCT	179	5.78	8.1	4.0	6.9	3.9
NOV	157	5.23	6.3	4.0	6.7	4.2
DEC	155	5.00	7.1	2.9	7.5	4.8
TOTAL	1784	-	-	-	65.9	-
AVERAGE	-	4.89	8.3	2.9	-	3.8

*Chlorinated 13 days flow 87.9 mg

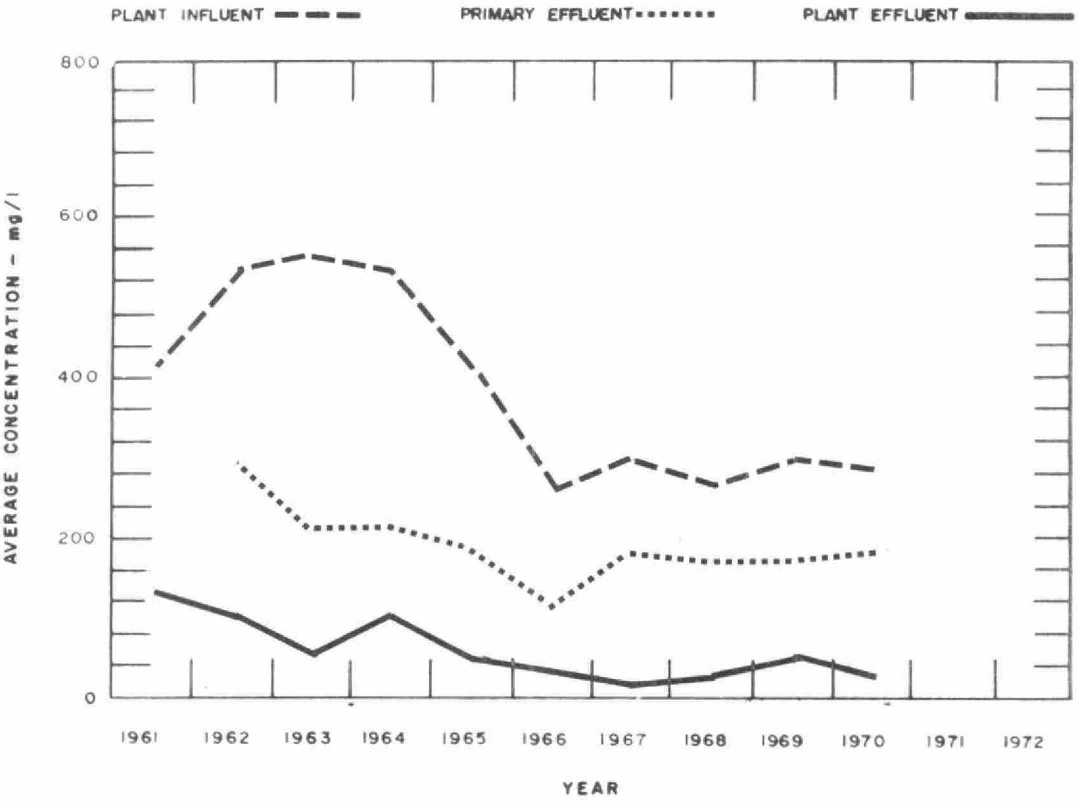


BIOCHEMICAL OXYGEN DEMAND





SUSPENDED SOLIDS



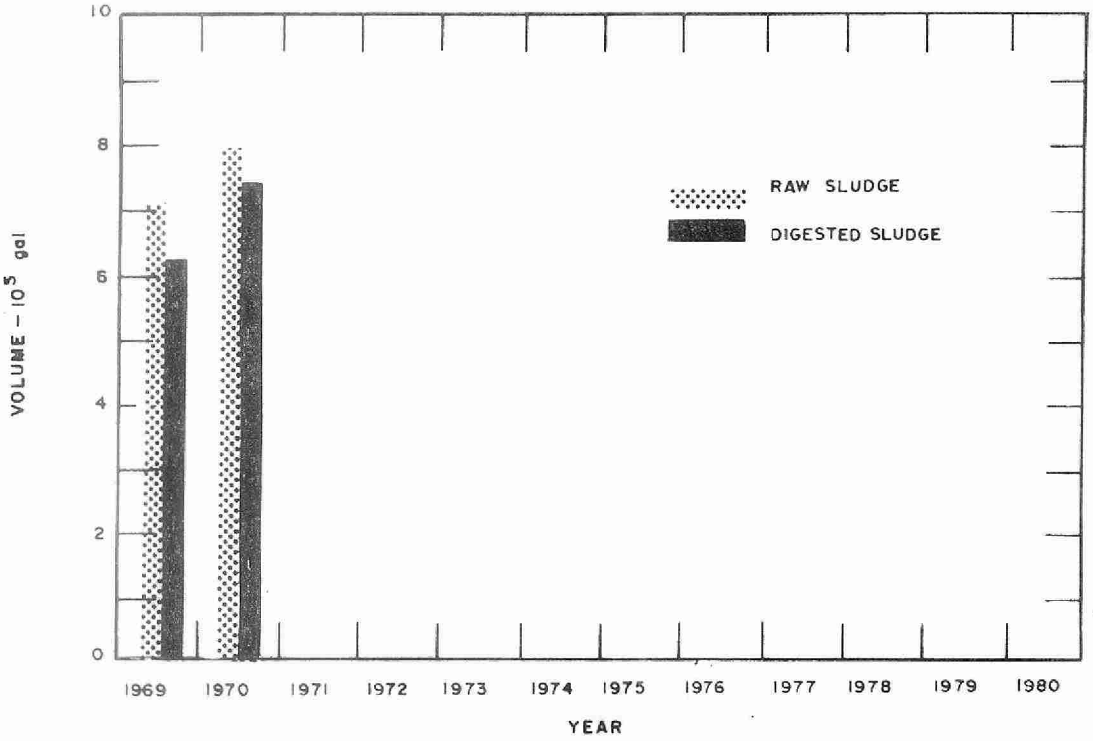
PLANT EFFICIENCY

MONTH	BIOCHEMICAL OXYGEN DEMAND						SUSPENDED SOLIDS						GRIT REMOVED
	INFLUENT		EFFLUENT		REDUCTION		INFLUENT		EFFLUENT		REDUCTION		
	n	mg/l	n	mg/l	%	10^5 pounds	n	mg/l	n	mg/l	%	10^5 pounds	cu ft
JAN	15	275	15	21	92	3.9	15	240	15	25	90	3.3	183
FEB	9	290	9	27	91	3.7	18	271	18	43	84	3.2	223
MAR	7	283	15	19	93	3.8	19	253	19	25	90	3.3	260
APR	9	416	8	27	96	5.6	23	243	22	42	84	2.9	186
MAY	7	338	6	10	97	4.4	19	305	18	27	91	3.7	120
JUNE	7	452	7	15	97	5.9	23	340	22	21	94	4.3	62
JULY	2	192	2	12	94	2.7	22	348	22	19	95	4.9	785
AUG	12	307	12	16	95	4.2	21	295	21	20	95	6.0	48
SEPT	8	340	9	33	97	5.7	17	303	18	52	83	4.2	372
OCT	9	457	9	28	94	7.7	20	335	22	30	91	5.4	380
NOV	6	393	6	36	91	5.6	19	279	19	28	90	4.0	366
DEC	9	221	9	30	86	3.0	21	206	21	31	85	2.7	388
TOTAL	100		107			56.2	237		237			47.9	3383
AVERAGE		332		22	92			286		30	89		

NOTE – n is the number of samples taken

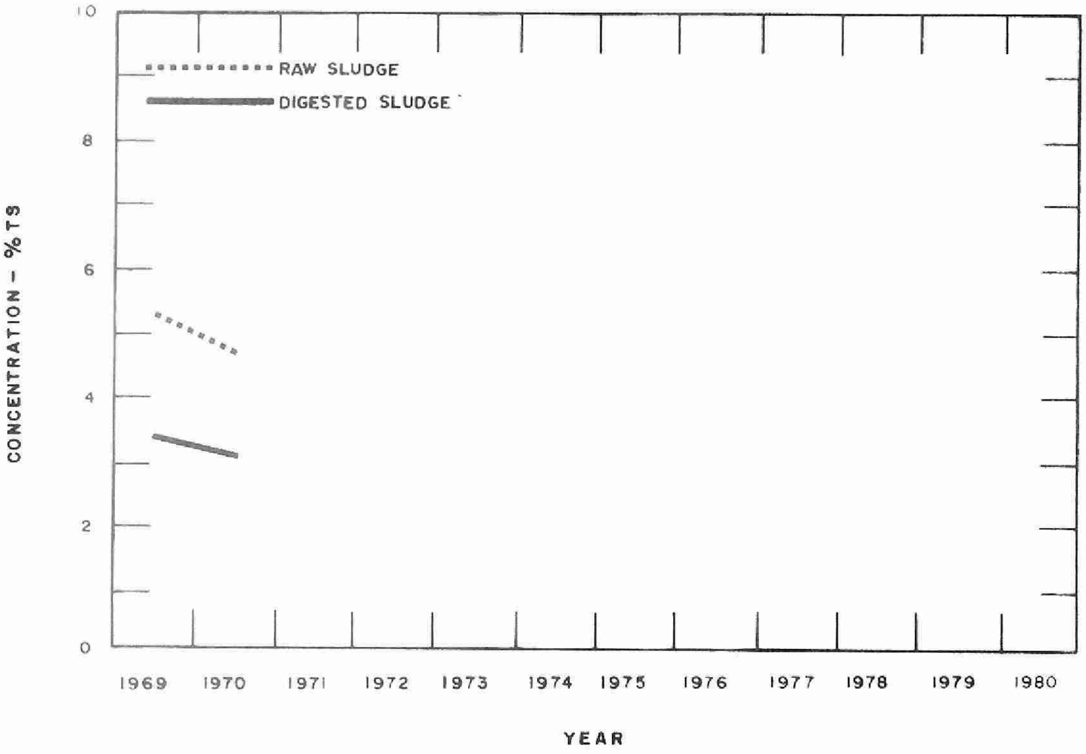
AERATION

MONTH	AVG DAILY FLOW mil gal	AERATION INF.		SECONDY. EFF.		MLSS CONCN mg/l	F/M lb BOD / lb MLSS	AIR USED 1000 cu ft / lb BOD	WASTE SLUDGE 10^3 lb/day
		BOD mg/l	SS CONCN mg/l	BOD mg/l	SS CONCN mg/l				
JAN	5.0	225	197	21	25	3550	.21	.6	15
FEB	5.0	309	145	27	43	3320	.31	.4	29
MAR	4.7	230	150	19	25	3060	.23	.6	37
APR	4.8	210	169	27	40	2990	.45	.6	31
MAY	4.2	334	226	10	27	2990	.31	.4	34
JUNE	4.5	280	295	15	21	3590	.24	.4	46
JULY	4.9	170	190	12	19	2740	.59	.7	38
AUG	5.0	296	282	16	20	2700	.36	.3	31
SEPT	5.0	234	164	33	52	2450	.31	.5	55
OCT	5.8	192	106	28	30	2560	.29	.5	33
NOV	5.3	232	219	36	28	2780	.30	.5	39
DEC	5.0	155	128	30	31	2360	.22	.1	32
TOTAL	-	-	-	-	-	-	-	-	-
AVERAGE	4.9	239	189	23	30	2920	.32	.5	35



VOLUME – 10^5 gal
0
2
4
6
8
10
RAW SLUDGE
DIGESTED SLUDGE
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
YEAR

DIGESTION



CONCENTRATION – % TS
0
2
4
6
8
10
RAW SLUDGE
DIGESTED SLUDGE
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
YEAR

SLUDGE DIGESTION and DISPOSAL

MONTH	RAW SLUDGE			DIGESTED SLUDGE			SUPERNATANT		SLUDGE DISPOSAL	
	VOLUME 10^5 gal	TOTAL SOLIDS %	VOL SOLIDS %	VOLUME 10^5 gal	TOTAL SOLIDS %	VOL SOLIDS %	VOLUME 10^5 gal	TOTAL SOLIDS %	DEWATERED cu yd	LIQUID cu yd
JAN	6.0	3.9	70	1.9	3.2	55	1.3	-	-	1237
FEB	7.4	3.9	71	8.6	2.6	56	-	-	-	4947
MAR	8.4	4.3	68	5.7	2.4	-	-	-	-	3381
APR	8.5	4.8	65	5.7	2.4	-	-	-	-	3381
MAY	9.1	4.3	71	7.8	2.7	56	-	-	-	4604
JUNE	9.2	3.8	70	8.0	2.7	56	-	-	-	4732
JULY	6.8	4.5	62	9.8	2.9	58	-	-	-	5850
AUG	9.9	4.5	61	4.2	4.1	49	-	-	-	2463
SEPT	6.4	5.1	63	7.9	3.7	50	-	-	-	4681
OCT	4.2	7.2	67	4.2	3.9	50	-	-	-	2516
NOV	5.4	4.5	65	2.9	3.9	52	-	-	-	1728
DEC	11.8	5.1	64	6.9	2.5	54	-	-	-	4076
TOTAL	83.1	-	-	73.6	-	-	-	-	-	43596
AVERAGE	-	4.7	66	-	3.1	54	-	-	-	-

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